Abductive Reasoning as the Foundation for Taking Advantage of Emergence
Deborah Dougherty

in Taking Advantage of Emergence: Productively Innovating in Complex Innovation Systems

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The author’s research with Danielle Dunne explains how and why abductive learning enables innovators to make good use of emergent information, but many others also describe something like abduction for complex problems. This chapter illustrates complexity and emergence in pharmaceuticals, and explicates three overlapping abductive learning routines that discovery scientists use to create new drugs: (1) using clues to imagine a configuration of interdependencies among possible product elements; (2) elaborating and narrowing to evaluate the hypothesis; and (3) iteratively integrating across perspectives and contexts to reframe the hypothesis. Prevailing routines for reasoning based on simple rationality cannot cope with complexity, and inhibit the use of abductive learning. The chapter summarizes ideas from studies of science, learning, innovation, and organizing that also reflect abductive learning and heedful interrelating. It is hoped that this synthesis helps to move analysis beyond conceptual churning in place to apply ideas to solve complex problems.

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Our most pressing societal problems such as enhancing health care, developing alternate energy, revitalizing cities, and advancing the economy are complex innovation systems. Leveraging the enormous
potential of sciences and technologies into better resolutions for these complex social and economic challenges requires a transformation in social technologies we use to tap into this potential. We can grapple with these complex innovation systems effectively only by taking advantage of emergence. This book articulates three new social technologies that organize infrastructures of complex innovation systems for taking advantage of emergence. The social technologies centre on abduction, or the logic of discovery, for figuring out solutions to complex problems. Abductive reasoning differs significantly from deductive confirmation and simple rationality. This book details three abductive learning routines that enable innovators to grab noisy and fragmented information, synthesize it into configurations that capture the inherent ambiguity, evaluate these configurations by exploring consequences and contingencies, and reframe to accumulate the learning. The second social technology divides the infrastructure into four distinct but entangled subsystems of interpersonal action: the project, knowledge system, strategic, and institutional subsystems. Each subsystem is a vast multi-organizational network that must address its distinct problem if the infrastructure overall is to productively innovate. The book shows how cycling through abductive learning routines overcomes problems in each subsystem that conventional approaches cannot deal with. The third social technology is a new way of organizing based on heedful interrelating and heterarchy, not hierarchy.

The Project Subsystem in the Infrastructure for Complex Innovation Systems
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Organizations began generating streams of new products only recently. Building products that actually solve customer problems required new social technologies for extensive interdisciplinary work to figure out the product, and for coordinating working in parallel. Complexity requires new social technologies again, to figure out how to build products with so many unknowns, and to coordinate work over such long periods. Examples illustrate the inherent complexity of drug development, how scientists use abductive learning routines to figure out how to build products by taking advantage of emergence, and how they use event-time pacing to coordinate. However, project scientists do not use
abductive learning or event-time pacing well, in part because knowledge scientists and managers impose their own problems onto the projects. Tensions between the different groups are illustrated to argue that R&D productivity in the pharmaceutical infrastructure cannot improve unless innovations in the other subsystems take place simultaneously.